Molecules, Transport and Health - Questions by Topic

Q1.

Question number	Answer	Additional guidance	Mark
(a)	A calculation which: • measured widths of wall as 10 mm and 30 mm (1) • shows the difference between widths, divided by smaller value (1) • × 100% (1) Example of calculation: (30 − 10) = 20 mm (20 ÷ 10) × 100 = 200%	Accept measurements consistent with printed image Correct answer with no working gains all 3 marks	(3)

Question number	Answer	Mark
(b)	An explanation that includes the following points: • formation of blood clot / thickening of artery wall (1) • therefore {blocks / narrows} coronary arteries (1) • therefore reduces blood flow (1) • therefore deprives heart muscle of {oxygen / nutrients} (1)	(4)

Question number	Answer	Additional guidance	Mark
(c)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material indicated as relevant. Additional content included in the response must be scientific and relevant. **Indicative content** • increased cholesterol increases chance of dying from CVD • cholesterol concentrations are different in different countries • same cholesterol level does not confer same risk in different countries • greater the cholesterol to HDL ratio, the greater the risk of CVD • the smaller the diameter the LDL, the greater the risk of CVD • individuals at greatest risk of CVD are those with a large cholesterol to HDL ratio and small LDL diameter and a high cholesterol concentration • not possible to say if different risks for a particular cholesterol concentration in the first study are due to differences in cholesterol to HDL ratio / diameter of LDL	Allow differences in the first study may be due to differences in cholesterol to HDL ratio / diameter of LDL	(6)

Level	Marks	Descriptor
	0	No awardable content.
1	1-2	A scientific assessment is made of a factor, supported by the application of limited relevant evidence from the scientific information provided. No conclusion is attempted.
2	3-4	A scientific assessment is made of some of the factors, supported by the application of some relevant evidence from the analysis and with some interpretation of the scientific information. A conclusion, where needed, is made, demonstrating linkages to elements of biological knowledge and understanding, with some evidence to support the assessment being made.
3	5-6	A scientific assessment is made of the factors, supported throughout by sustained application of relevant evidence from the analysis and interpretation of the scientific information. A conclusion, where needed, is made, demonstrating sustained linkages to biological knowledge and understanding, with sufficient evidence to support the assessment being made.

Q2.

Question number	Answer	Mark
(a)(i)	A	(1)

Question number	Answer	Mark
(a)(ii)	C	(1)

Question number	Answer	Mark
(b)(i)	B at 0.4 seconds	(1)

Question number	Answer	Additional guidance	Mark
(b)(ii)	A calculation in which: • volume of blood per beat from graph = 59 cm³ (1) • heart rate calculated from graph = 75 bpm (1) • volume of blood converted into dm³ (1) Example of calculation: (59 × 75) ÷ 1000 = 4.425 dm³	Accept 109 – 50 Correct answer with no working shown gains all three marks	(3)

Question number	Answer	Mark
(c)	An explanation that includes the following points: • dissociation curve for the llama is to the left of that for the human (1) • therefore llama haemoglobin has a higher affinity for oxygen (1) • llama haemoglobin will be fully saturated with oxygen at lower partial pressures (1) • this is necessary as there is less oxygen available in the atmosphere at high altitudes where llamas live (1)	(4)

Q3.

Question number	Answer	Additional guidance	Mark
(a)	A calculation in which: • actual height of elephant • how many times taller the elephant is than the mouse	Example of calculation: 4.5 ÷ 0.02 = 225 / 230 / 235 (cm) 75 / 76.67 / 76.7 / 77 / 78 / 78.3 / 78.33 **IGNORE** units	(2)

Question number	Answer	Additional guidance	Mark
(b)	A description that includes the following points: • attachment of lungs to {chest cavity / diaphragm} {increases volume / decreases pressure} (1) Any **two** from: • alveoli provide a large surface area for faster diffusion (1)	**ACCEPT** to {take in / hold} large volume of air **ACCEPT** thin walls	(3)
	• alveoli formed from {one cell layer / flattened / squamous} epithelial cells for small diffusion distance (1) • concentration gradient maintained by {ventilation / blood flow / good blood supply} (1)	**ACCEPT** large network of capillaries	

Question number	Answer	Mark
* (c)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material indicated as relevant. Additional content included in the response must be scientific and relevant. **Indicative content** • oxygen dissociation curve for the mouse is shifted to the right • mouse haemoglobin has a lower affinity for oxygen than the elephant haemoglobin • therefore haemoglobin can supply oxygen to the tissues at lower pp of oxygen • because the rate of respiration in the mouse is higher • a mouse has a higher mass-specific metabolic rate than the elephant • because the mouse loses more body heat • because it has a larger surface area to volume ratio • because the mouse is more active • because it has to escape predators • the rate of respiration of the mouse is going to be	(6)

| | greater than the elephant

• therefore pp of oxygen in mouse tissues will be lower

• therefore haemoglobin needs to be releasing oxygen

• when blood cannot supply oxygen at a fast enough rate | |

Level	Marks	
	0	No awardable content.
1	1-2	An explanation may be attempted but with limited interpretation or analysis of the scientific information and with a focus on mainly just one piece of scientific information. The explanation will contain basic information, with some attempt made to link knowledge and understanding to the given context.
2	3-4	An explanation will be given, with occasional evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows some linkages and lines of scientific reasoning with some structure.
3	5-6	An explanation is made that is supported throughout by sustained application of relevant evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows a well-developed and sustained line of scientific reasoning, which is clear and logically structured.

Q4.

Question number	Answer	Additional guidance	Mark
(a)(i)	• 9 : 1	**ACCEPT** 6 : 1 / 5 : 1	(1)

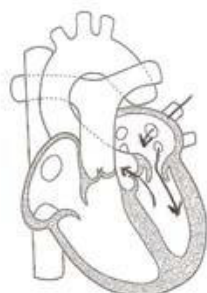| Question number	Answer	Additional guidance	Mark
(a)(ii)	A description that includes the following points: • will not have any effect on the total membrane phospholipids (1) • the inner layer will have a relatively higher content of the other phospholipids / the outer layer will have a relatively lower content of the other phospholipids (1)	**ACCEPT** increase phospholipid content in outer layer and decrease content in inner layer	(2)

Question number	Answer	Additional guidance	Mark
(a)(iii)	A description that includes the following points: • will alter membrane {properties / permeability / fluidity} (1) • so that platelets will release thromboplastin (1) • thromboplastin is {an enzyme / a catalyst} (1) • that converts prothrombin into thrombin (1)	**NB** thromboplastin catalyses prothrombin into thrombin = 2 marks	(4)

Question number	Answer	Additional guidance	Mark
(b)	An explanation that includes the following points: • thrombin is an <u>enzyme</u> (1) • because the inhibitor will change the shape of the active site (of thrombin) (1) • therefore thrombin cannot bind to fibrinogen (1) • therefore {less / no} fibrinogen will be converted into fibrin (1) • therefore there is {less / no} {mesh / fibrin / fibres} to trap {blood cells / platelets} (1)	**ACCEPT** inhibitor blocks the active site / fewer active sits available **ACCEPT** {less / no} thrombin to bind to fibrinogen / fewer collisions / fewer enzyme substrate complexes formed **ACCEPT** slower conversion	(4)

Q5.

Question number	Answer	Additional guidance	Mark
(a)	An explanation that includes the following points: • because (X / coronary artery) carries {oxygen / oxygenated blood} to the heart {cells / muscle / tissue} (1) • for {(aerobic) respiration / metabolism} (in the heart) (1) • aorta is closest blood vessel carrying oxygenated blood (1)	**IGNORE** glucose / nutrients **ACCEPT** aorta supplies X blood with <u>high levels of oxygen</u>	(3)

Question number	Answer	Additional guidance	Mark
(b)(i)	An explanation that includes the following points: • diastole / atrial systole / ventricular diastole (1) • because the {atrioventricular / AV / bicuspid / tricuspid} valves are open (1)	**ACCEPT** semi lunar valves are closed	(2)

Question number	Answer	Additional guidance	Mark
(b)(ii)	An answer that includes the following points: • arrows shown on left-hand side of heart (only) (1) • arrows pointing in correct direction (1) • arrows shown entering atrium through pulmonary vein and leaving through the aorta (1)	<u>example of diagram</u> 	(3)

Question number	Answer	Additional guidance	Mark
(c)	An explanation that includes the following points: • increase in diameter due to {high pressure / large volume / surge} of blood (leaving the left ventricle) (1) • therefore expansion of elastic fibres (1) • decrease in diameter due to recoil (of elastic fibres) (1)	**ACCEPT** to reduce pressure of blood	(3)

Q6.

Question number	Answer	Mark
(a)(i)	The only correct answer is B. A is incorrect because it should be $C_n H_{2n} O_n$ C is incorrect because it should be $C_n H_{2n} O_n$ D is incorrect because it should $C_n H_{2n} O_n$	(1)

Question number	Answer	Additional guidance	Mark
(a)(ii)	• condensation (reaction)	IGNORE polymerisation	(1)

Question number	Answer	Mark
(b)(i)	The only correct answer is C. A is incorrect because amylose is a polysaccharide found in plants. B is incorrect because galactose is a monosaccharide. D is incorrect because sucrose is found in plants.	(1)

Question number	Answer	Mark
(b)(ii)	The only correct answer is C. A is incorrect because amylopectin is a polysaccharide. B is incorrect because galactose is a monosaccharide. D is incorrect because sucrose contains fructose.	(1)

Question number	Answer	Mark
(b)(iii)	The only correct answer is C. A is incorrect because amylose is found in plants. B is incorrect because fructose is a disaccharide found in plants. D is incorrect because sucrose is a disaccharide found in plants.	(1)

Question number	Answer	Mark
(b)(iv)	The only correct answer is B. A is incorrect because amylose is not branched. C is incorrect because fructose is a monosaccharide. D is incorrect because maltose is a disaccharide.	(1)

Q7.

Question number	Answer	Mark
(a)	**The only correct answer is B.** *A* is incorrect because anticoagulants prevent blood clotting. *C* is incorrect because platelet inhibitors reduce blood clotting. *D* is incorrect because statins reduce cholesterol levels.	(1)

Question number	Answer	Additional guidance	Mark
(b)	An explanation that includes the following points: • because there is a link between (total) blood cholesterol levels and heart disease (1) • because {HDL is not thought to be a risk factor / LDL is associated with the development of heart disease / the {ratio / balance} of LDL : HDL determines the level of risk} (1)	**ACCEPT** CHD / CVD / atherosclerosis for heart disease throughout **ACCEPT** causes / leads / is a risk factor / correlation **ACCEPT** HDL reduces risk / HDL needed to get the LDL	(2)

Question number	Answer	Additional guidance	Mark
(c)	An explanation that includes the following points: • (10 year CHD risk) increases (1) • because smoking {increases blood pressure / increases heart rate / damages (endothelial) lining of arteries} (1) • damage to lining results in {atheroma / plaque} building up OR {high blood pressure / increase in heart rate} makes the heart work harder (1)	**ACCEPT** CVD / CHD / heart disease / atherosclerosis / throughout **ACCEPT** increases the chance of blood clotting / makes platelets sticky **ACCEPT** blood clots can block arteries	(3)

Question number	Answer		Mark
(d)(i)	• salt intake / fibre intake / alcohol intake / (body) mass / BMI / obesity / hip waist ratio / level of exercise / stress levels / family history / genetic factors / taking statins / diastolic blood pressure	**IGNORE** LDL / antihypertensives / blood pressure	**(1)**

Question number	Answer	Additional guidance	Mark
(d)(ii)	• {salt / low fibre / alcohol / high BMI / obesity / little exercise / stress / family history / genetic factors / high diastolic blood pressure} increase the risk value OR {low salt / high fibre / low alcohol / suitable mass / exercise / low stress levels / taking statins / low diastolic blood pressure} decrease the risk value	**ACCEPT** if answer given in (i)	**(1)**

Question number	Answer	Additional guidance	Mark
(d)(iii)	An explanation that includes two of the following points: • because there are other (risk) factors not included (1) • because people will underestimate {their mass / how much they smoke} (1) • because {total cholesterol / HDL / blood pressure} might be an estimate (1)	**ACCEPT** named factor but not those shown on the risk calculator **ACCEPT** {total cholesterol / HDL / blood pressure} are variable are not aware that they have diabetes	**(2)**

Q8.

Question number	Answer	Mark
(a)(i)	D hydrolysis	(1)

Question number	Answer	Mark
(a)(ii)	A calculation in which: kJ of energy = mass of lactose in 200 g of milk × energy per gram Example of calculation: 4.9 × 2 × 16 = 156.8 kJ	(1)

Question number	Answer	Additional guidance	Mark
(b)	An answer that includes the following points: similarities: • both polysaccharides / formed from many (alpha) glucose monomers (1) • joined by glycosidic bonds (1) differences: • starch is composed of two polysaccharides, glycogen only one (1) • amylose is a {straight / helical} chain, amylopectin and glycogen are both branched molecules (1)	Allow description of glycosidic bonds as 1,4 and 1,6	(4)

Question number	Answer	Additional guidance	Mark
(c)(i)	An answer that includes one of the following points: • saturated lipids have no carbon - carbon double bonds **and** unsaturated lipids have a carbon - carbon double bond or • saturated lipids have straight chains **and** unsaturated lipids have bent chains or • saturated lipids have a great**er** ratio of hydrogen to carbon / unsaturated lipids have a low**er** ratio of hydrogen to carbon	Answer must be comparative	(1)

Question number	Answer	Mark
(c)(ii)	An description that includes the following points: • one glycerol molecule and three fatty acid molecules (1) • which react via a condensation reaction (1) • and are joined by ester bonds (1)	(3)